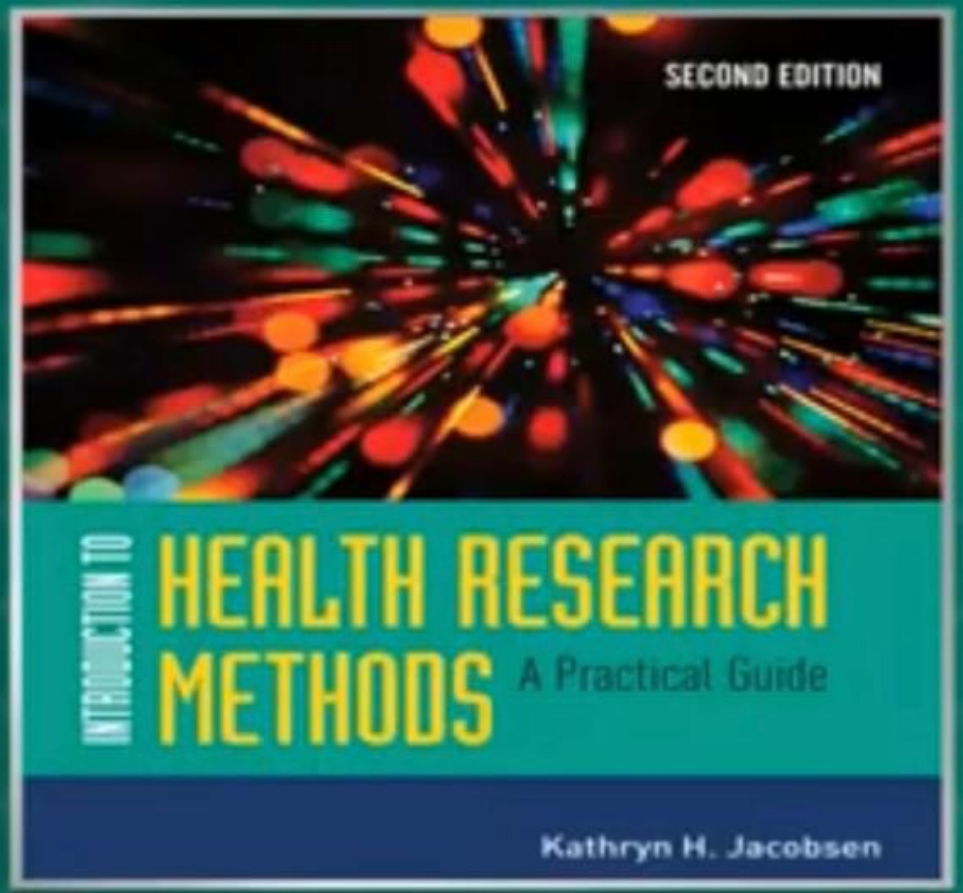
SCIENTIFIC MEDICAL RESEARCH

Week 9

Systematic Reviews and Meta-Analyses

Chapter 22



22.1 Overview

All reviews require:

1. An extensive search of the literature;
2. The extraction of key information from relevant articles;
3. The clear & concise presentation of this information.

FIGURE 22-1 Key Characteristics of Reviews and Meta-Analyses

Approach	Narrative Review	Systematic Review	Meta-Analysis
Objective	Synthesize existing knowledge	Synthesize existing knowledge	Synthesize existing knowledge
Primary study question	What conclusions about this topic are supported by previous studies?	When all previously published studies on this topic are examined, what conclusions can be drawn?	When the results of all previously published studies on this topic are merged, what is the summary statistic?
Population	Published literature	Published literature	Published literature
When to use the approach	The goal is to describe a new perspective on a topic that can be supported by the existing literature.	The goal is to compare the findings of previous studies on a well-defined topic.	The goal is to summarize previous findings using pooled statistics.
Requirements	The researcher has excellent library access.	The researcher has excellent library access.	The researcher has excellent library access.
	The researcher has a unique perspective on the topic.	The researcher can obtain every relevant article.	The researcher has strong quantitative skills.

FIGURE 22-1 (continued)

Approach	Narrative Review	Systematic Review	Meta-Analysis
First steps	1. Decide what story the article will tell.	1. Decide on the specific objectives of the review. 2. Select the search methods that will be used to find potentially relevant articles. 3. Select inclusion and exclusion criteria for articles.	1. Decide on the specific objectives of the review. 2. Select the search methods that will be used to find potentially relevant articles. 3. Select the inclusion and exclusion criteria for the articles. 4. Decide how to assess the quality of the studies. 5. Decide how the results of the studies will be combined into one summary statistic.
What to watch out for	Limited publication venues	Publication bias	Studies that cannot be fairly compared
Key statistical measure	No statistics are required.	No statistics are required, but providing some results from included studies may be helpful.	Summary measures for included studies must be reported.

22.2 Selecting a Topic

- Each review needs to have an appropriate scope
- Most successful reviews have more than just a few articles & less than hundreds of articles.

22.3 Library Access

- Check with an institutional librarian about policies & prices for accessing articles that are not part of the library's collection.

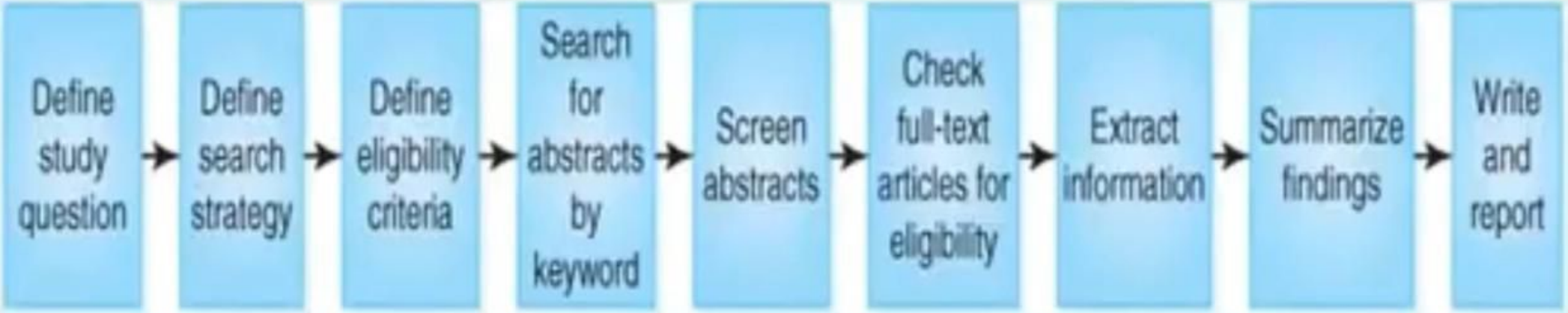
22.4 Narrative Reviews

- *Narrative reviews* tell a story about a topic using evidence from the literature to support the "plot".
- A narrative review works best when the researcher has a unique perspective on a topic and/or a particular expertise in the field.

22.5 Systematic Reviews

- *Systematic reviews* use a predetermined & comprehensive searching & screening method to identify relevant articles while minimizing bias.
- The systematic review process:
  - Identification of an appropriately narrow study question
  - Selection of a well-defined & valid search strategy
  - Screening of all potentially relevant articles
  - Extraction of relevant information from all eligible articles
  - Summarization of the findings of these articles

Figure 22-2



22.6 Search Strategy

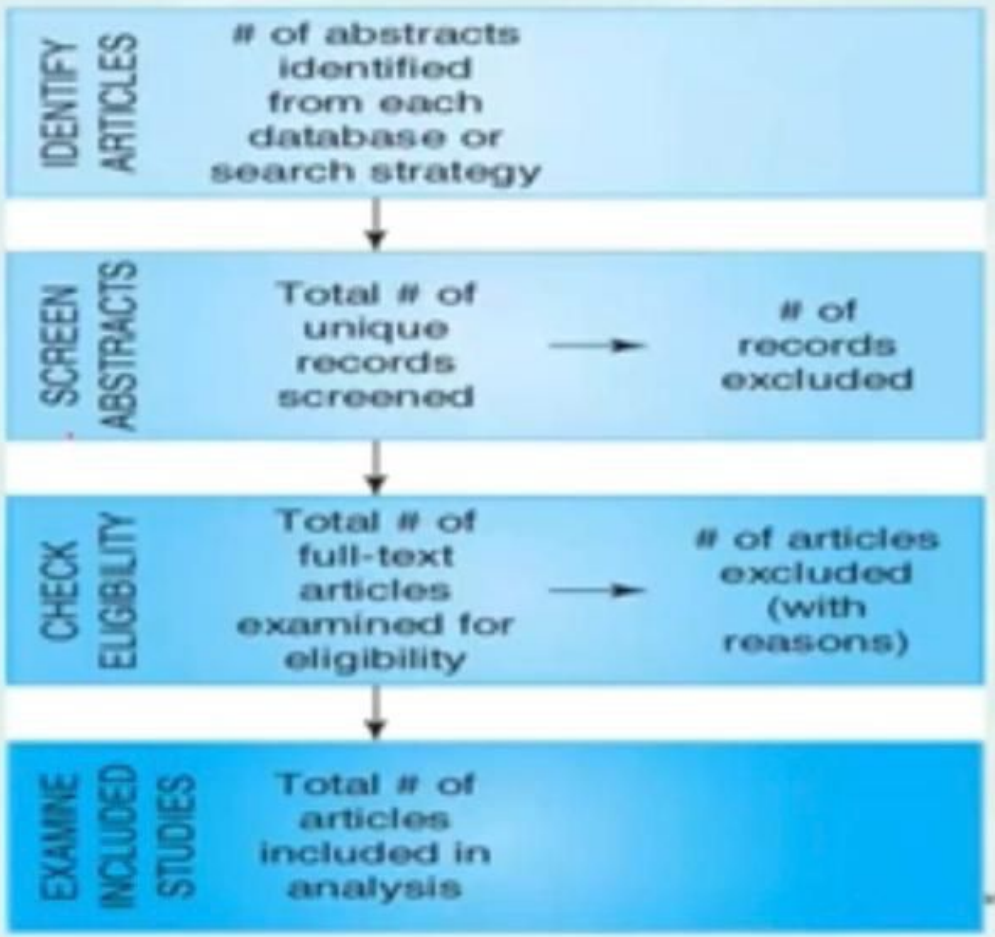
- The MeSH dictionary (available through PubMed.org) can help with focusing or expanding search terms.
- Use *Boolean operators* such as AND, OR, and NOT.
- Confirm that the selected search string will capture several articles known to meet the eligibility criteria.

FIGURE 22-3 Examples of Using Boolean Operators to Expand or Restrict the Number of Abstracts Identified in a Database

Search String	Approximate Number of "Hits" in PubMed
cancer	3.5 million
bladder cancer	70,000
schistosomiasis	25,000
"schistosomiasis"[Mesh]	21,000
Schistosomiasis mansoni	10,000
cancer AND schistosomiasis	1500
bladder cancer AND schistosomiasis	650
bladder cancer AND *Schistosomiasis mansoni*	40
bladder cancer OR schistosomiasis	90,000
bladder cancer NOT schistosomiasis	65,000
colorectal cancer	200,000
colorectal cancer AND schistosomiasis	150
bladder cancer AND colorectal cancer AND schistosomiasis	20
(bladder cancer OR colorectal cancer) AND schistosomiasis	800

Note: Because the PubMed database is constantly adding new abstracts, the numbers in this table will not exactly match the results of a new search.

Figure 22-4: **Systematic Search Strategy & Counts to Report**



22.7 Search Limiters

- Be careful about decisions to limit the search databases screened, the languages or publication years of articles, and other choices that may reduce the number of articles identified by the search.

22.8 Eligibility Criteria

- Create both a list of inclusion criteria & a list of exclusion criteria prior to screening the articles.
- Be prepared to justify all criteria, especially those related to quality screening.
- Consider whether to use *snowballing* & the *gray literature* to expand the search.

22.9 Data Extraction

- A data extraction table allows for easy compilation & comparison of observations relevant to the study question.

22.10 Systematic Review Results

- Record & report both statistically significant findings and those showing no association.
- Watch out for the ***publication bias*** that occurs when articles with statistically significant results are more likely to be published than those with null results.

22.11 Meta-Analysis

- *Meta-analysis* combines into one summary statistic the results of several high-quality quantitative studies that used similar methods to collect & analyze their data.
- The meta-analysis process:
  - Use a systematic search strategy to identify relevant articles.
  - Carefully read each study.
  - Assess the quality & comparability of each study.
  - Extract statistical results from each of the eligible studies.
  - Combine comparable statistical results into one summary statistic.

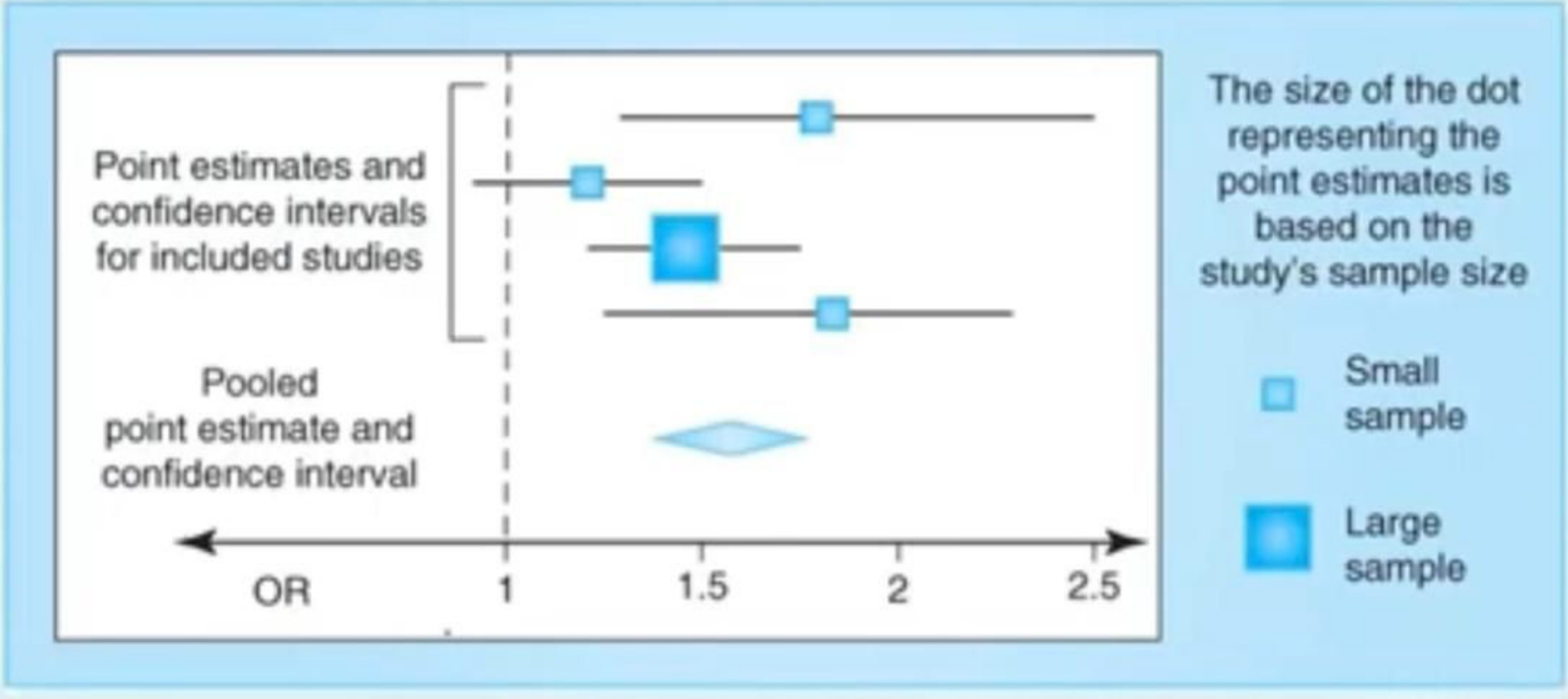
22.12 Pooled Analysis

- *Homogeneous* (similar) studies can be combined into a summary statistic, but caution should be used if the studies are *heterogeneous* (dissimilar).
- The amount of variability in the measure between studies can be examined using a *Cochran's Q* statistic for homogeneity and the I^2 statistic.
- A *fixed effects model* can be used to create a pooled estimate when the studies are fairly homogenous.
- A *random effects model* is required when the tests of heterogeneity show that the included studies are dissimilar.

22.13 Forest Plots & Funnel Plots

- A ***forest plot*** displays the contributing studies and the summary measure for a meta-analysis.
- A ***funnel plot*** visually displays the likelihood of studies missing from the analysis because of publication bias.

Figure 22-5: **Example of a Forest Plot**



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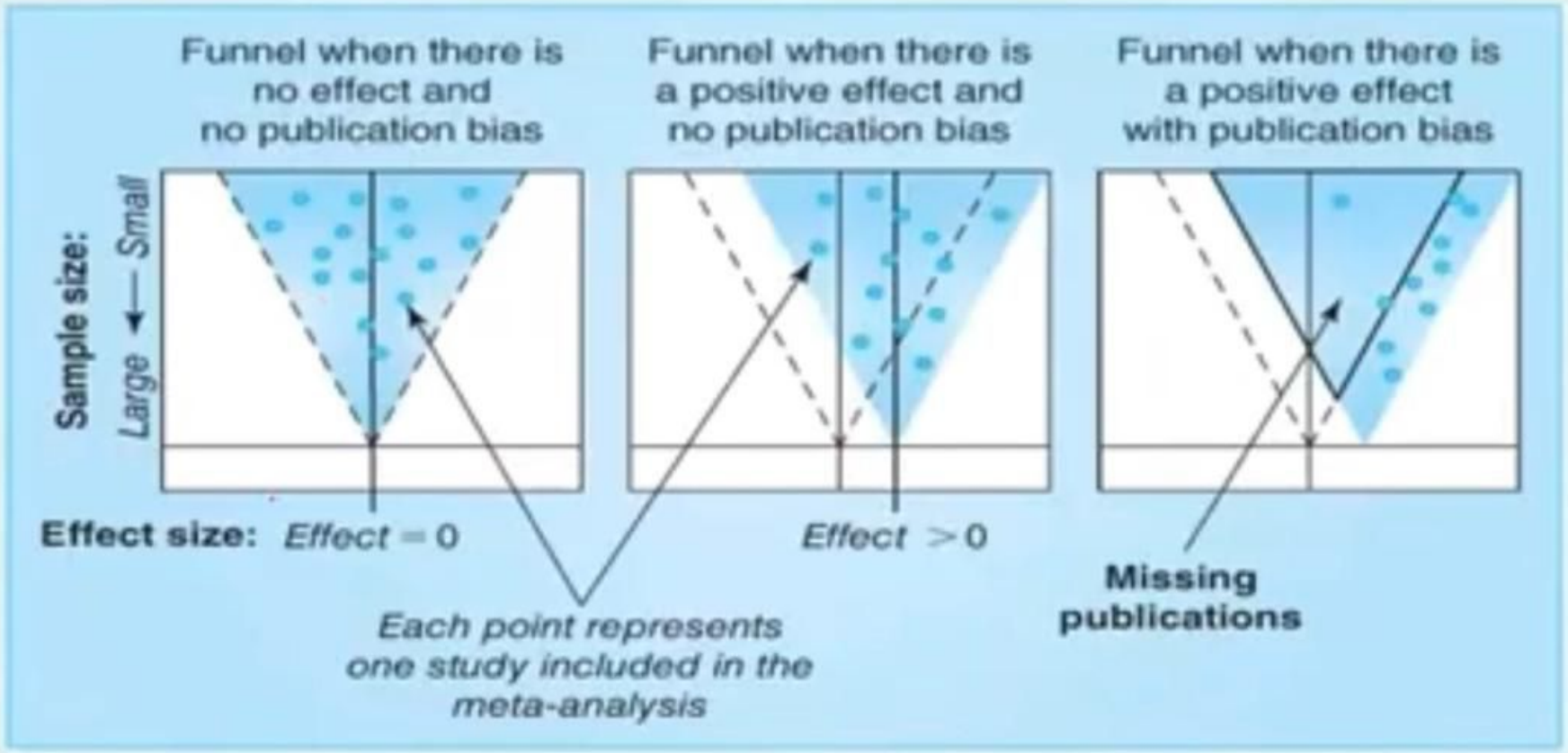
- A ***funnel plot*** visually displays the likelihood of studies missing from the analysis because of publication bias.

Figure 22-6: **Example of a Funnel Plot**



The End
Good Luck